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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/671,143	09/25/2003	Ji Ung Lee	125695-1	4553

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GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
PATENT DOCKET RM. BLDG. K1-4A59
NISKAYUNA, NY 12309

EXAMINER	
MCDONALD, RODNEY GLENN	

ART UNIT	PAPER NUMBER
1753	

DATE MAILED: 07/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/671,143	LEE ET AL.	
	Examiner	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-57 and 99* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-57 and 99* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-6, 9, 13-19, 22-27, 29, 31-38, 42-48, 51, 52, 54-56, 99 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (U.S. Pat. 6,339,281) in view of Jin (US PGPUB 2004/0067602).

Regarding claims 1, 32, 99, Lee et al. teach a method for fabricating a triode carbon nanotube field emitter array. (See Abstract) The method comprises providing a substrate 1 of glass with a cathode electrode 2. (Column 4 lines 1-3) A dielectric material is deposited on the surface of the substrate. (Column 4 lines 4-7) Depositing a conductor layer in the form of a gate electrode on the surface of the dielectric layer.

(Column 4 lines 7-10) Gate openings 5 are formed by etching at selective locations. (Column 4 lines 10-13; Fig. 2C) The dielectric layer is electively etched in the locations of the openings 5 to form a micro-cavities 6. (Column 4 lines 14-16) In Fig. 4A a base layer structure is deposited in the micro-cavity adjacent the surface of the substrate and the base layer in the microcavity has a substantial concial shape. (Column 5 lines 5-10; Fig. 4A) A catalyst layer is deposited on the base layer structure suitable for growing at least one carbon nanotube. (Column 5 lines 17-20) Carbon nanotubes are grown on the catalyst layer as self-aligned. (Column 5 lines 27-34; Fig. 4D)

Regarding claims 2, 33, the substrate is deposited metal on glass. (Column 4 lines 2-3)

Regarding claims 3, 34, the dielectric material is oxide or nitride. (Column 4 line 5)

Regarding claims 4, 35, the oxide can be silicon dioxide. (Column 4 line 5)

Regarding claims 5, 36, the nitride can be silicon nitride with a nitrogen content of 1.33. (Column 4 line 5)

Regarding claims 6, 37 the gate electrode by its nature is conducting and conducting materials cover metals or semiconductors. (Column 4 lines 4-9)

Regarding claims 9, 38, a separation layer 7 is deposited on the conductor layer electrode. (Column 4 lines 25-27) Here the separation layer 7 is interpreted to be the sacrificial layer.

Regarding claims 13, 42, a base layer 8 and 8' is deposited on the sacrificial layer and a portion of the substrate. (Column 5 lines 5-10)

Regarding claims 14, 43, the base layer can comprise metal such as Au, Pt or Nb. (Column 5 lines 5-10)

Regarding claims 15, 44, the base layer can comprise metal such as Au, Pt or Nb. (Column 5 lines 5-10)

Regarding claims 16, 45, a catalyst material is deposited on the surface of the base layer. (Column 5 lines 17-21)

Regarding claims 17, 46, the sacrificial layer is removed along with the corresponding base layer and corresponding catalyst layer. (Column 5 lines 28-32)

Regarding claims 18, 47, the catalyst comprises at least one transition metal. (Column 5 lines 17-20)

Regarding claims 19, 48, the catalyst comprises Ni or Co. (Column 5 lines 17-20)

Regarding claims 25, 54, at least one carbon nanotube is grown by chemical vapor deposition. (Column 5 lines 27-28)

Regarding claim 31, the structure is a self-aligned triode carbon nanotube field emitter array. (See Abstract)

The differences between Lee et al. and the present claims is that utilizing an electrical potential to cause a field to form at the substrate such that the carbon nanotubes grow in a direction perpendicular to the surface of the substrate is not discussed (Claims 1, 32, 99), the length of the carbon nanotube is not discussed (Claims 22, 23, 51, 52), the carbon nanotube being single walled double walled or multi-walled is not discussed (Claims 24), the use of a flowing carbon source is not discussed

(Claims 26, 55) the carbon source being methane is not discussed (Claims 27, 56) and the carbon tube being a metallic carbon nanotube is not discussed (Claim 29).

Regarding utilizing an electrical potential to cause a field to form at the substrate such that the carbon nanotubes grow in a direction perpendicular to the surface of the substrate (Claims 1, 32, 99), Jin teach growing nanowires form catalyst by CVD utilizing a globally applied field along the vertical direction (perpendicular to the substrate) or by an intrinsically present electrical field perpendicular to the substrate to produce vertically grown nanowires. (Page 3 paragraph 0050; Page 1 paragraph 0014)

Regarding the length of the carbon nanotube (Claims 22, 23, 51, 52), Jin teach that the length of the nanotube can be 1-500 nm. (Page 4 paragraph 0062)

Regarding the carbon nanotube being single walled, double walled or multi-walled (Claim 24), Jin suggest that the nanotubes can be multiwalled. (Page 1 paragraph 0014)

Regarding the use of a flowing carbon source (Claims 26, 55), Jin suggest utilizing methane to produce the nanotubes. (Page 1 paragraph 0014)

Regarding the use of methane (Claims 27, 56), Jin suggest utilizing methane to produce the nanotubes. (Page 1 paragraph 0014)

Regarding the carbon tube being a metallic carbon nanotube (Claim 29), Jin teach that the CVD gas can be mixed with Fe in order to produce a metallic type carbon nanotube. (Page 1 0014).

The motivation for utilizing the methods of Jin is that it produces aligned carbon nanotubes. (See Page 3 paragraph 0050)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Lee et al. as taught by Jin because it allows for growth of carbon nanotubes.

Claims 7, 10-12 and 39-41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. in view of Jin as applied to claims 1-6, 9, 13-19, 22-27, 29, 31-38, 42-48, 51, 52, 54-56, 99 above, and further in view of Keesmann et al. (RE38,561).

The differences not yet discussed is that the conductor layer being metal (Claims 7), the material of the sacrificial layer (Claims 10, 39), depositing the sacrificial layer at an angle (Claims 11, 40) and rotating while depositing the sacrificial layer is not discussed (Claims 12, 41).

Regarding the conductor layer being metal, Keesman et al. teach forming the gate electrode of molybdenum. (Column 5 lines 37-39)

The motivation for utilizing Mo as a conductor is that it allows formation of a gate electrode. (Column 5 lines 37-39)

Regarding the material of the sacrificial layer (Claims 10, 39), Keesman et al. teach that the material of the sacrificial layer can be aluminum. (Column 5 lines 45-53)

Regarding depositing the sacrificial layer at an angle (Claims 11, 40), Keesman et al. teach depositing the sacrificial layer at an angle. (Column 5 lines 45-53)

Regarding rotating while depositing the sacrificial layer (Claims 12, 41), Keesman et al. teach rotating while depositing. (Column 5 lines 45-53)

The motivation for depositing a particular sacrificial material while rotating and depositing at an angle is that it allows for preventing closing of the cavity. (Column 5 lines 45-53)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized Mo and to have deposited a particular sacrificial material while rotating and depositing at an angle as taught by Keesman et al. because it allows for formation of gate electrode and for preventing closing of the cavity.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. in view of Jin as applied to claims 1-6, 9, 13-19, 22-27, 29, 31-38, 42-48, 51, 52, 54-56, 99 above, and further in view of Takemura (U.S. Pat. 5,620,350).

The differences not yet discussed is that the semiconductor material being doped poly silicon is not discussed (Claim 8)

Regarding the semiconductor being doped poly silicon (Claim 8), Takemura teach that the gate electrode can be made of doped poly silicon by CVD. (Column 4 lines 5-11)

The motivation for utilizing doped polysilicon is that it always formation of a gate electrode. (Column 4 lines 5-11)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized doped polysilicon as taught by Takemura because it allows formation of a gate electrode.

Claims 20, 21, 49 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. in view of Jin as applied to claims 1-6, 9, 13-19, 22-27, 29,

31-38, 42-48, 51, 52, 54-56, 99 above, and further in view of Zhang et al. "Electric field directed growth of aligned single walled carbon nanotubes", Applied Physics Letters, Volume 79, Number 19, November 5, 2001, pg. 3155-3157.

The differences not yet discussed is the electrical potential applied to the substrate and the conductor layer (Claims 20, 49) and the electrical field induced (Claims 21, 50)

Regarding the electrical potential applied to the substrate and the conductor layer (Claims 20, 49), Zhang et al. teach utilizing a bias voltage of 5 V to cause alignment of carbon nanotubes. (See Page 3155)

Regarding the electrical field induced (Claims 21, 50), Zhang et al. teach a 1300 V/cm field for producing the nanotubes. (See Fig. 2 b)

The motivation for controlling the electrical potential and induced electric field is that it allows for producing aligned carbon nanotubes. (See Page 3155)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a potential applied to the substrate and induced electric field as taught by Zhang et al. because it allows for producing aligned carbon nanotubes.

Claims 28 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. in view of Jin as applied to claims 1-6, 9, 13-19, 22-27, 29, 31-38, 42-48, 51, 52, 54-56, 99 above, and further in view of Bower et al. "Plasma-induced alignment of carbon nanotubes", Applied Physics Letters, Volume 77, Number 6, August 2000, pg. 830-832.

The differences not yet discussed is the temperature for deposition (Claims 28, 57)

Regarding the temperature for deposition (Claims 28, 57), Bower et al. teach that the temperature for CVD can be 825 degrees C. (See Page 830).

The motivation for utilizing a temperature of 825 degrees C is that it allows deposition of carbon nanotubes. (See Page 830)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized 825 degrees C for depositing as taught by Bower et al. because it allows for deposition of carbon nanotubes.

Claims 30 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. in view of Jin as applied to claims 1-6, 9, 13-19, 22-27, 29, 31-38, 42-48, 51, 52, 54-56, 99 above, and further in view of Bower et al. "Plasma-induced alignment of carbon nanotubes", Applied Physics Letters, Volume 77, Number 6, August 2000, pg. 830-832.

The differences not yet discussed is utilizing chemical vapor deposition for the layers (Claims 30, 53)

Regarding deposition the layers be chemical vapor deposition (Claims 30, 53), Huang teach that the dielectric material and the conductor layer can be deposited by chemical vapor deposition. (Huang Column 3 lines 62-68; Column 4 lines 1-4) Chen teach depositing a base layer 401 for carbon nanotubes 402 by CVD. (Chen Column 3 lines 59-65) Lee et al. teach depositing the catalyst layer and the carbon nanotube layer by CVD. (See Lee et al. Column 4 lines 30-33; Column 5 lines 27-28)

The motivation for utilizing CVD to deposit the layers is that it allows for formation of emitter devices. (See Abstracts of Huang, Chen and Lee et al.)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized CVD for depositing the layers as taught by Huang, Chen and Lee et al. because it allows for formation of emitter devices.

Response to Arguments

Applicant's arguments filed May 9, 2006 have been fully considered but they are not persuasive.

In response to the argument that the prior art of record does not "applying an electric potential between a substrate and a conductive layer", it is argued that Applicant's claims require "applying an electrical potential to the substrate and the conductor layer" and that Jin teach applying an electrical potential to the substrate and the conductor in an electrical field that is either global or intrinsically present. The claim do not recite that that electrical field is "between" the substrate and the conductive layer. However, the electrical field would run between the substrate and the conductor layer due to the shape of the electrical field. (See Jin discussed above)

In response to the argument that there is no motivation for creating a field within the device itself by applying an electrical potential to its own layer, it is argued that the claims require "applying an electrical potential to the substrate and the conductor layer" and the Jin teach applying an electrical potential to the substrate and the conductor in an electrical field that is global or intrinsically present. The global or intrinsic field would apply the electrical field to the layers. (See Jin discussed above)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
July 17, 2006